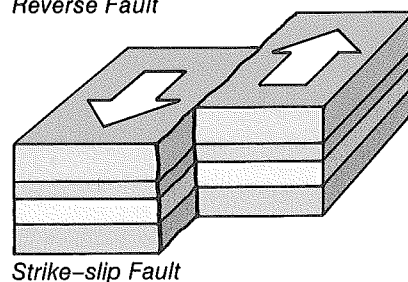
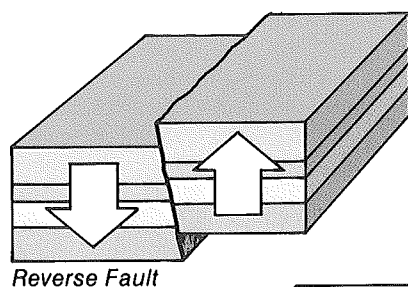
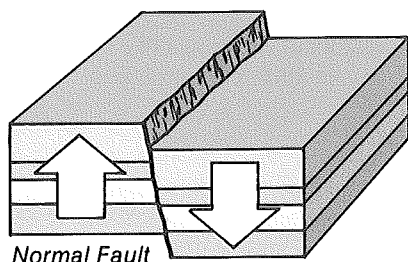


OBJECTIVES

- A** Name three kinds of faults and give examples of each.
- B** Identify two kinds of folds, explain how they are described, and name a well-known folded mountain range.
- C** Discuss the importance of volcanism to the formation of the Himalayas, the Andes, and the Cascades.

16.3 Three basic types of faults



II Features of Collision Mountains

Topic 4 Faults

A fault is a break or crack in Earth's crust along which movement has occurred. The surface that separates the two moving pieces is the *fault plane*. Movement along fault planes causes the earthquakes that accompany mountain building (Chapter 15, Topic 2). There are three basic kinds of faults.

A **normal fault** occurs when the rocks on one side of the fault plane drop down with respect to the rocks on the other side. Normal faults occur in areas where tension is pulling the crust apart. An example is the Baikal Rift System in southern Russia. Here a piece of crust dropped down between two normal faults. The valley that resulted from the movement now contains Lake Baikal, the deepest lake in the world. Since normal faults are caused by stresses pulling away from each other, they are not common in collision mountains.

A **reverse fault** occurs when one side of the fault plane is driven up over the other side. These faults result from stresses that push toward each other. Reverse faults are important to mountain building because they allow the crust to be shortened as the plates collide. If the fault plane is nearly level, large pieces of crustal material can be moved great distances. This process is the thin-skinned thrusting described in Chapter 13. It is an important feature of most of the world's mountain ranges.

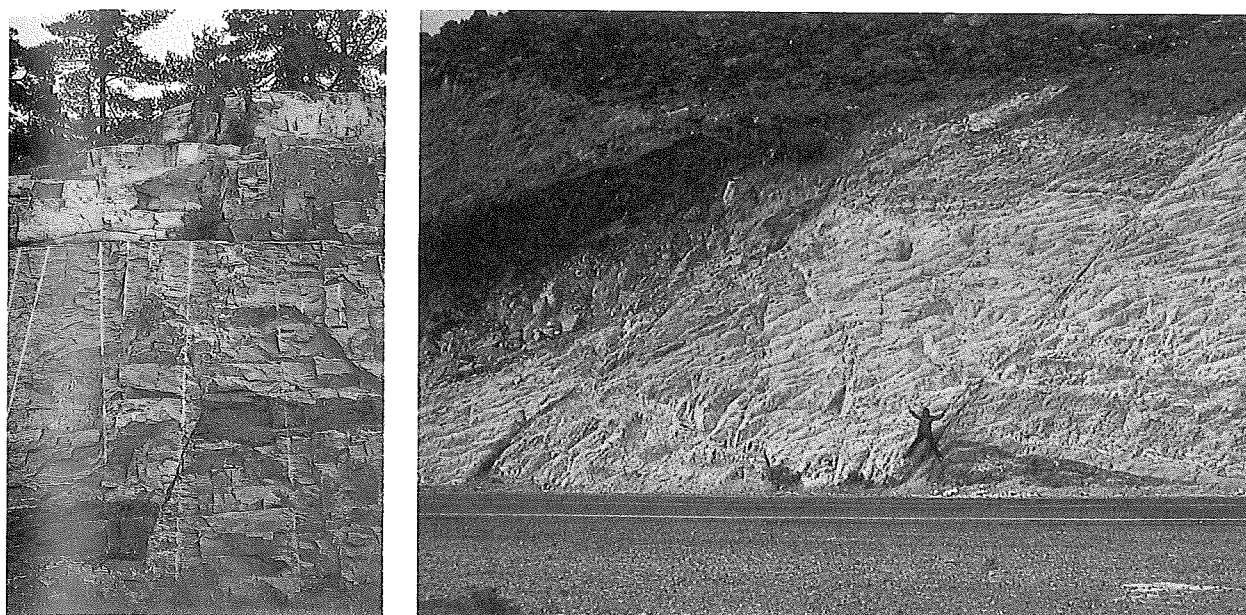
A third kind of fault is a **strike-slip fault**. In this fault, the rocks on opposite sides of the fault plane move horizontally past each other. The San Andreas Fault is a well-known example (Chapter 15, Topic 15).

In the Himalayas, strike-slip faults are more common than reverse faults. These faults result as India pushes rock material aside on its drive into Eurasia. Strike-slip faulting has occurred over a large area. In some cases, the fault planes are over 3000 kilometers away from India. There is even some evidence that earthquakes in China are the result of the Indian-Eurasian collision.

Topic 5 Folds

During plate collisions, the rock layers along the continental margins are crumpled into folds. A number of terms are used to describe these folds.

An **anticline** is an upfold in the rock layers. A **syncline** is a downfold. The sides of the folds are called *limbs*. The steepness, or *dip*, of the limbs reflects the intensity of folding. Limbs may be gently dipping, steeply dipping, straight up and down, or even overturned.

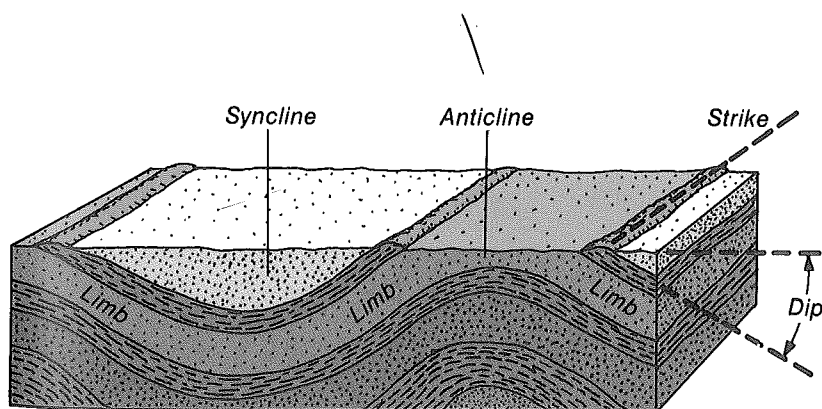


16.4 (a) Normal fault, (b) reverse fault

The compass direction of the fold or of the rock layers exposed at the surface along the fold is called the *strike*.

In some folded mountains the folding is severe, and the rock layers are badly deformed. In others, the layers have been pushed into gentle anticlines and synclines.

A well-known example of folded mountains is the Valley and Ridge Province of the Appalachian Mountains. The rock layers there have not been badly crumpled. Instead, the stress of collision has formed the layers into long, narrow folds. Interestingly, the valleys between the mountains do not correspond to fold synclines nor the ridges to fold anticlines as one might expect. Instead, the locations of the valleys and ridges are controlled primarily by the weathering rates of the rocks in different areas of the folds.



16.5 An anticline is an upfold in rock layers, and a syncline is a downfold. The strike is the direction of the fold, and the dip is the steepness of the fold.

Topic 6 Volcanoes

Volcanic rocks are not common in the Himalayas, but some do occur on the northern edge of the range. These rocks may have formed during the time the Indian Plate was still subducting under the Eurasian Plate but before the two continents collided.

Volcanism has been important throughout the history of the Andes. In fact, the core of the Andes is a granite batholith that apparently supplied magma to many surface volcanoes. Erosion removed the volcanoes long ago, but the batholith and the feeder dikes to the volcanoes are still present. These features are now easily visible at the surface. The batholith is exposed over an area of about 3000 square kilometers and, because granite resists erosion, contains the highest peaks of the Andes. These peaks make up the Cordillera Blanca, or White Range, so named because the mountains are always covered with snow. A similar batholith forms the core of the Sierra Nevada in California. Many geologists believe that the Andes of today resemble the Sierra Nevadas of 100 million years ago and the Northern Appalachians of 450 million years ago.

The eruption of Mount St. Helens in 1980 focused attention on volcanism in North America. The Cascade Range, in which Mount St. Helens is located, is a classic example of an active volcanic mountain range.

TOPIC QUESTIONS

Each topic question refers to the topic of the same number.

4. (a) Describe the movement of rocks in a normal fault. (b) How did Lake Baikal form? (c) How are rocks moved in a reverse fault? Explain why reverse faults are important to mountain building. (d) Describe the movement in a strike-slip fault and give an example. (e) Which type of fault is most important in the Himalayas?
5. (a) How do anticlines and synclines differ? (b) Where are the limbs of a fold? (c) What is meant by the dip of the limbs of a fold? (d) What is strike? (e) How are the valleys and ridges of the Appalachians related to the anticlines and synclines that occur there?
6. (a) When were the volcanic rocks of the Himalayas thought to have formed? (b) What is the Cordillera Blanca and how does it relate to volcanism in the Andes? (c) How are the Andes thought to be related to the Sierra Nevadas and to the Northern Appalachians? (d) What kind of mountain range is the Cascade Range?